



Civil & Environmental Consultants, Inc.

# **Beneficial Use of Coal Combustion Residuals for Closure of Coal Ash Impoundments and Landfills**

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Environmental Show of the South 2018  
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**Presented By  
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# Outline of Presentation

- ▶ **Drivers for Coal Combustion Residual (CCR) Impoundment and Landfill Closure**
- ▶ **Beneficial Use Regulations**
- ▶ **Case Study**



# Drivers for Closure of Coal Combustion Residual Impoundments/Landfills

- ▶ **Environmental regulations**
- ▶ **Market conditions**



# Federal Environmental Regulatory Drivers for Coal-Fired Plant Closures

- ▶ **Mercury and Air Toxics Standards (MATS)**
- ▶ **Clean Power Plan (current USEPA Administration proposing to repeal)**
- ▶ **Steam Electric Power Generating Effluent Limitation Guidelines (ELGs)**
- ▶ **USEPA CCR Regulation**



# Regulatory Drivers for Closure

- ▶ **State Specific Waste Management Regulations**
- ▶ **USEPA CCR Regulation**



# Regulatory Drivers - Closure

## ▶ State Specific Waste Management Regulations

- Generally must close within 1 year of ceasing to accept CCR unless alternate schedule is approved
- May require revising final waste grades to achieve minimum slopes if permitted grades are not reached (premature closure)
- Install final cover system and surface water management system controls



# Regulatory Drivers - Closure

## ▶ USEPA CCR Regulation - Existing Landfill

- Required to cease accepting CCR within 6 months of
  - failure to demonstrate adequate factor of safety for stability, or
  - failure to demonstrate compliance with location standard for unstable areas

# Regulatory Drivers - Closure

## ▶ USEPA CCR Regulation - Existing Unlined Surface Impoundment

- Required to cease accepting CCR within 6 months of
  - failure to demonstrate adequate factor of safety for stability
  - statistical exceedance of groundwater standard, or
  - failure to demonstrate compliance with location standards including 5 feet of separation from aquifer system, wetlands, fault areas, seismic impact zone, or unstable areas

# Regulatory Drivers - Closure

## ▶ USEPA CCR Regulation Closure Period

- For landfills, complete within 6 months of commencing closure activities
- For impoundments, complete within 5 years of commencing closure activities
  - May extend time to complete closure if demonstration can be made that 5 years is not feasible.
  - Impoundments less than 40 acres may extend up to 2 years
  - Impoundments greater than 40 acres may extend up to 2 years in 5 separate extensions for a total of 10 years



# Market Drivers

## ▶ Percent electrical generation by source

		2006	2016
Coal		50	30
Natural Gas		20	34
Nuclear		20	20
Hydropower		7	7
Wind, solar, biomass		2	8
source US Energy Information Administration			

# Market Drivers

- ▶ **Cheap, abundant natural gas as a result of horizontal directional drilling and hydraulic fracking**
- ▶ **Advances in wind and solar electric generation**
- ▶ **From 2008 to 2016, 17% of coal-fired generating capacity retired**
- ▶ **4% of coal-fired plants converted to natural gas**
- ▶ **One study estimates 40% of remaining coal-fired plants to shut down in next two years. Some may be converted to natural gas-fired**
- ▶ **Twenty-five percent of the plants have a target retirement date**



# Beneficial Use of CCR for Closure

- ▶ **Permitted in some state regulations as structural fill (not required to be in a disposal area)**
  - Place in maximum 2 feet lifts
  - Compact to 90% of modified Proctor density
  - Maximum slope of 2.5H:1V
  - pH greater than 7.0
  - Control surface water runoff
  - Test total chemical and leaching analysis
  - Maintain minimum distance from streams, wetlands, water supply
- ▶ **Requirements are consistent with typical operation of CCR disposal facility**

# USEPA CCR Rule Beneficial Use Criteria

- ▶ (1) The CCR must provide a functional benefit;
- ▶ (2) The CCR must substitute for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction;
- ▶ (3) The use of the CCR must meet relevant product specifications, regulatory standards or design standards when available, and when such standards are not available, the CCR is not used in excess quantities; and



# USEPA CCR Rule Beneficial Use Criteria

- ▶ (4)a. When unencapsulated use of CCR involving placement on the land of 12,400 tons or more in non-roadway applications, the user must demonstrate and keep records, and provide such documentation upon request, that environmental releases to groundwater, surface water, soil and air are comparable to or lower than those from analogous products made without CCR, or
- ▶ (4)b. that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use.
- ▶ Unencapsulated use is CCR not mixed with cement or used in wallboard.



# USEPA CCR Rule Beneficial Use Criteria

► **First three criteria can be met when CCR is used as structural fill at an impoundment or landfill to increase slopes**

- (1) provide a functional benefit
- (2) substitute for the use of a virgin material
- (3) meet relevant product specifications, regulatory standards or design standards



# USEPA CCR Rule Beneficial Use Criteria

## ▶ Fourth criteria requires site-specific evaluation to demonstrate compliance

(4)a. demonstrate that environmental releases are comparable to or lower than those from analogous products, or

(4)b. demonstrate that environmental releases will be at or below regulatory and health-based benchmarks.

## ▶ USEPA has provided a suggested methodology (not addressed in this presentation)



# **USEPA Proposed Revisions to CCR Rules**

## **Phase I Remand Rule**

- ▶ Filed March 15, 2018 for interested party comment**
- ▶ Comment period ended April 30, 2018**
- ▶ Among the changes proposed is to allow CCR to be used in certain closure situations**



# USEPA Proposed Revisions to CCR Rules

## Phase I Remand Rule

- ▶ **Current regulations prohibit placing additional CCR in units required to close due to groundwater quality exceeding protection standard, not complying with location restriction, and not meeting minimum factor of safety for stability.**
- ▶ **Proposed change because there are environmental and public health benefits in allowing CCR to be used for closure by allowing facilities to be closed more quickly and reducing risks**



# **USEPA Proposed Revisions to CCR Rules**

## **Phase I Remand Rule**

- ▶ USEPA Risk Assessment demonstrated that risk was not sensitive to depth of CCR**
- ▶ Leachate concentration at the bottom of waste mass would not increase due to increased thickness**
- ▶ Risk is very sensitive to infiltration rate into and out of disposal facility**



# USEPA Proposed Revisions to CCR Rules

## Phase I Remand Rule

- ▶ **Material must have been generated on-site and be present at the time of closure**
- ▶ **Material may be used only for grading and contouring of the final cover system, not to fill up a partially full unit**
- ▶ **Placement must be within the vertical plane of the unit**
- ▶ **Material may only be used to construct a cover no steeper than 5% unless approved by State**



# USEPA Proposed Revisions to CCR Rules

## Phase I Remand Rule

- ▶ **Prior USEPA interpretation allows CCR from multiple units to be consolidated into a single unit. No limitation on volume.**
- ▶ **Soliciting comments on continuing this interpretation or clarify that only CCR needed for contouring can be placed in the unit.**

## Case Study

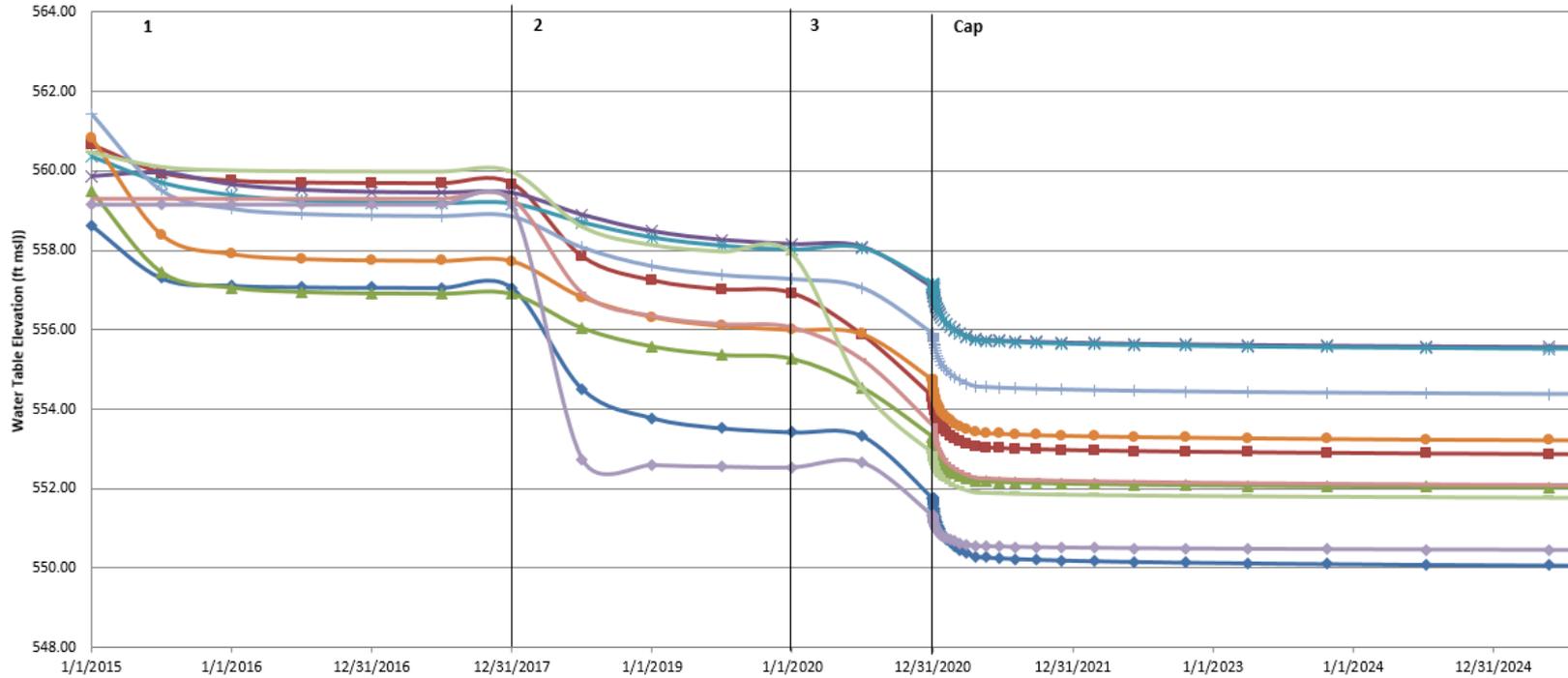
- ▶ **Operating CCR impoundment nearly filled to permitted capacity with fly ash and bottom ash**
- ▶ **Currently, only bottom ash fines disposed in impoundment. Fly ash hauled off-site for beneficial use in mine reclamation**
- ▶ **Generator pays hauling fees for mine reclamation**

## Case Study

- ▶ **Permitted final grades 1% slope**
- ▶ **Groundwater modeling predicted drop in water table within CCR during and following closure**
- ▶ **Water table drop results in settlement of CCR as it consolidates leading to potential ponding on final cover and reduction of surface water runoff**



# Groundwater Model Prediction



# Groundwater Model Prediction

- ▶ **Average 20 feet drop in water table occurring over 5 to 10 years**
- ▶ **Result of operations removing standing water while placing CCR for beneficial use and final cover installation**



# Geotechnical Investigation

- ▶ **14 Geoprobe Borings**
- ▶ **12 Rotary Auger Borings**
- ▶ **12 Piezometers**
- ▶ **Laboratory Testing Program**



# Proposed Design

- ▶ **Proposed placing CCR as beneficial use to increase final grades to maximum 3% slope**
- ▶ **Designed to accommodate the predicted settlement and the expected volume of CCR that would be generated during the closure period**



## Predicted Settlement

- ▶ **Using geotechnical drilling information, laboratory data and modeled water table drop, predicted settlement**
- ▶ **No flat areas or depressions that would pond water following closure**



# Conclusions

- ▶ **Market and regulatory drivers causing decommissioning of coal-fired power plants and closure of CCR impoundments and landfills**
- ▶ **Current and proposed regulations allow beneficial use of CCR as structural fill which can be used for impoundment / landfill closure**
- ▶ **Expect reductions in water levels within the CCR as a result of reducing standing water and installing final cover system**
- ▶ **Water level drop within CCR can lead to settlement with the potential for ponding**



# Conclusions

- ▶ **Increasing the final cover slopes with CCR increases the post-closure slopes after settlement, increasing surface water runoff and reducing the potential for long-term ponding**
- ▶ **Beneficial use requirements for structural fill are consistent with site operating practices**
- ▶ **Results in economical CCR disposal for power generator**



# Questions?

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